Adenda nº 1

Proyecto ejecutivo de instalación híbrida renovable "PE-IFV Los Morales", LMT de interconexión PE y subestación elevadora 66/30 kV en los TT.MM. de El Puerto de Santa María, Jerez de la Frontera y Sanlúcar de Barrameda (Cádiz)

Potencia instalada fotovoltaica: 18,49 MW
Potencia instalada eólica: 31,50 MW
Capacidad de acceso: 31,50 MW

Promotor**: Iberian Retail Bernesga 6, S.L.U.**

Ingeniería: **Ingnova Proyectos**

Octubre 2023

ÍNDICE

1. Datos generales

1.1. Objeto

El objeto de la presente adenda es modificar la altura de buje de los aerogeneradores dispuestos en *el Proyecto Ejecutivo de Instalación Híbrida renovable PE-IFV "Los Morales", LMT de interconexión PE y Subestación Elevadora 66/30 kV en los TT.MM de El Puerto de Santa María, Jerez de la Frontera y Sanlúcar de Barrameda (Cádiz)* con número de expediente AT-15322/22.

En el proyecto ejecutivo de julio de 2023 se contempla la máquina N175/6.X del fabricante Nordex con 175 m de diámetro de rotor y una altura de buje de 142 metros. En la presente adenda, se plantea la modificación de la altura de buje de dicha máquina a 125 metros.

1.2. Identificación del titular

El titular del proyecto es la sociedad Iberian Retail Bernesga 6, S.L.U., con C.I.F.: B-90409533 y con domicilio a efectos de notificaciones en la C/ Avenida Charles Darwin, s/n, Pabellón Monorraíl, CP: 41092, Sevilla, España.

1.3. Orden de encargo

La sociedad mercantil Iberian Retail Bernesga 6, S.L.U., con domicilio en C/ Avenida Charles Darwin, s/n, Pabellón Monorraíl, CP: 41092, Sevilla, España y CIF: B-90409533 encarga a Don Manuel Cañas Mayordomo en representación de Ingnova Enterprise, S.L. con domicilio a efectos de notificaciones en C/ Tomas de Aquino 14, Local en Córdoba (C.P.: 14004) y CIF: B-56006984, la elaboración del **"Adenda nº 1 del Proyecto ejecutivo de instalación híbrida renovable "PE-IFV Los Morales", LMT de interconexión PE y subestación elevadora 66/30 kV en los TT.MM. de El Puerto de Santa María, Jerez de la Frontera y Sanlúcar de Barrameda (Cádiz)"**

2. Descripción del parque eólico

El viento produce el movimiento de las palas del aerogenerador y a través de un sistema mecánico de engranajes hacen girar al rotor. Esta energía rotacional del rotor se transforma en energía eléctrica por el generador. En el presente parque eólico, se han dispuesto siete (7) aerogeneradores configurados para el modo de potencia de 4.500 kW.

Número de aerogeneradores	Potencia Unitaria (MW)	Potencia configurada unitaria (MW)	Potencia total (MW)

7	6,80	4,50	31,50

Tabla 1. Datos aerogeneradores

La ubicación de cada uno de los aerogeneradores en las parcelas se ha realizado en base a las direcciones predominantes del viento obtenidas durante la evaluación del recurso eólico.

Las turbinas se instalan en torres tubulares con una altura de buje de 125 m y están formadas por un rotor de 175,00 m de diámetro, equipado con tres palas que forman un ángulo de 120º entre ellas.

2.1. Aerogeneradores

El aerogenerador previsto en el Parque eólico Los Morales es el modelo N175/6.X del fabricante Nordex con 175 m de diámetro de rotor y una altura de buje de 125 metros.

El Parque eólico Los Morales se instalarán siete (7) aerogeneradores configurados para el modo de potencia de 4,50 MW, para alcanzar la potencia instalada de 31,5 MW.

2.1.1. Ubicación

A continuación, se muestra una tabla con las coordenadas UTM (ETRS89 – Huso 29) de las posiciones de los aerogeneradores del parque eólico.

Aerogenerador	X	Y	Término municipal	Provincia
WTG01	744.393	4.066.559	Jerez de la Frontera	Cádiz
WTG02	744.447	4.066.043	Jerez de la Frontera	Cádiz
WTG03	744.084	4.065.644	El Puerto de Santa María	Cádiz
WTG04	743.040	4.066.633	Jerez de la Frontera	Cádiz
WTG05	742.684	4.066.255	El Puerto de Santa María	Cádiz
WTG06	745.092	4.063.165	El Puerto de Santa María	Cádiz
WTG07	745.445	4.062.539	El Puerto de Santa María	Cádiz

Tabla 2. Ubicación aerogeneradores

2.1.2. Descripción del aerogenerador

El modelo de aerogenerador N175/6.X del fabricante Nordex es una turbina tripala a barlovento con rotor de diámetro 175 m y capaz de generar hasta 6,80 MW.

La turbina y la góndola están montadas en la parte superior de una torre tubular de acero de 125 m de altura.

El aerogenerador cuenta con un sistema de orientación activo (para mantener el rotor permanente a barlovento), regulado con desvío activo de pitch con un generador de velocidad variable y convertidor electrónico.

Además, está regulado por un sistema de cambio de paso independiente de cada pala. Dicho sistema permite operar al aerogenerador a velocidad variable maximizando en todo momento la potencia producida y minimizando las cargas y el ruido.

Datos del Aerogenerador	
Potencia (MW)	6,80
Potencia configurada (MW)	4,50
Altura de buje (m)	125
Diámetro de rotor (m)	175,00
Orientación	Barlovento
Número de palas	3 – eje horizontal
Clase de diseño	IIIB
Área de barrido (m2)	24.053
Tipo de generador	Máquina de inducción doblemente alimentada de 6 polos
Tipo de trasformador	Trifásico
Potencia nominal de transformador (kVA)	7.8000
Tensión de generación (V)	950
Tensión de media tensión (kV)	30
Frecuencia (Hz)	50

Tabla 3. Datos del aerogenerador

Córdoba, octubre de 2023

El Ingeniero Técnico Superior

Fdo. Manuel Cañas Mayordomo
Colegiado 1.617

El Ingeniero Industrial

Fdo. Daniel Correro Cabrera
Colegiado 7.426

Anexo I: Estudio de recurso eólico

INGNOVA PROYECTOS
Consultoría Agronómica e Industrial
mcm@ingnova.es
www.ingnova.es

C/ Tomás de Aquino, 14 (Local)
14.004 – Córdoba - España
Tlf: +34 957 08 92 33
Móvil: 655 35 98 99

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Main Result

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m

Wake Model N.O. Jensen (RISØ/EMD) Park 2 2018

Calculation performed in UTM (north)-WGS84 Zone: 29
At the site centre the difference between grid north and true north is: 1,6°

Power curve correction method
New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>
Air density calculation method
Height dependent
Base temperature: 18,0 °C at 177,0 m
Base pressure: 997,0 hPa at 177,0 m
Air density for Site center in key hub height: 40,0 m + 125,0 m = 1,190 kg/m³ -> 97,1 % of Std
Relative humidity: 50,0 %

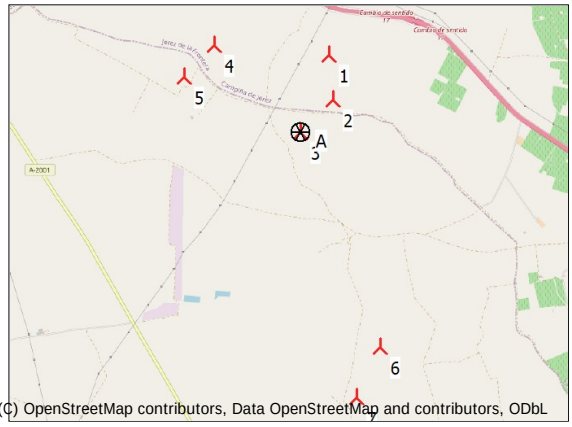
Wake Model Parameters
Wake decay constant 0,090 DTU default onshore
Hub height independent

Wake calculation settings

Angle [°]			Wind speed [m/s]		
start	end	step	start	end	step
0,5	360,0	1,0	0,5	30,5	1,0

Wind statistics ES VORTEX-Data-AEG-03 - 125.00 m.wws

WAsP version WAsP 12 Version 12.08.0032



Scale 1:75.000
New WTG Site Data

Key results for height 125,0 m above ground level

Terrain UTM (north)-WGS84 Zone: 29

	Easting	Northing	Name of wind distribution	Type	Wind energy	Mean wind speed	Equivalent roughness
					[kWh/m²]	[m/s]	
A	744.084	4.065.644	Datos de empl.: WAsP (8)	WAsP (WAsP 12 Version 12.08.0032)	3.195	7,0	1,8

Calculated Annual Energy for Wind Farm

WTG combination	Result PARK	Result-9,2%	GROSS (no loss) Free WTGs	Wake loss	Specific results¤) Capacity factor	Mean WTG result	Full load hours	Mean wind speed @hub height
	[MWh/y]	[MWh/y]	[MWh/y]	[%]	[%]	[MWh/y]	[Hours/year]	[m/s]
Wind farm	161.278,7	146.441,0	168.059,4	4,0	35,1	20.920,1	3.076	7,1

¤) Based on Result-9,2%

Calculated Annual Energy for each of 7 new WTGs with total 47,6 MW rated power

	Links	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Power curve Creator	Name	Annual Energy Result	Result-9,2%	Wake loss	Free mean wind speed
					[kW]	[m]	[m]			[MWh/y]	[MWh/y]	[%]	[m/s]
1	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	24.040,8	21.829	5,0	7,33
2	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	22.491,7	20.422	5,7	7,06
3	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	22.240,3	20.194	5,2	6,99
4	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	22.972,5	20.859	4,1	7,07
5	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	23.074,5	20.952	4,1	7,10
6	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	23.091,9	20.967	2,1	7,01
7	A	Yes	NORDEX	N175-6.X-Mode 0-6.800	6.800	175,0	125,0	USER	N175-6.X-Mode 3 HH179m	23.366,8	21.217	2,0	7,06

WTG siting

UTM (north)-WGS84 Zone: 29

		Easting	Northing	Z [m]	Row data/Description
1	New	744.393	4.066.559	70,0	AEG-01
2	New	744.462	4.066.039	47,2	AEG-02
3	New	744.084	4.065.644	35,0	AEG-03
4	New	743.040	4.066.633	34,2	AEG-04
5	New	742.707	4.066.259	35,0	AEG-05
6	New	745.092	4.063.165	33,4	AEG-06
7	New	744.824	4.062.568	35,0	AEG-07

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
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09/10/2023 17:38/3.6.366

PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 1 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	12.057	18.161	23.973	29.087	33.362	36.754
NORDEX N175-6.X-Mode 0 6800 175.0 !-! N175-6.X-Mode 3 HH179m	[MWh]	12.229	18.323	24.017	28.750	32.245	34.466
Check value	[%]	-1	-1	0	1	3	7

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

Original data, Air density: 1,225 kg/m³

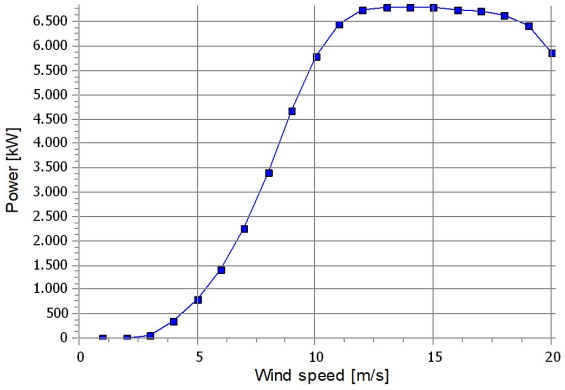
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
3,0	74,0	0,19	3,0	0,87
3,5	195,0	0,31	3,5	0,87
4,0	360,0	0,38	4,0	0,85
4,5	567,0	0,42	4,5	0,84
5,0	815,0	0,44	5,0	0,83
5,5	1.110,0	0,45	5,5	0,82
6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
17,0	6.691,0	0,09	17,0	0,14
17,5	6.671,0	0,08	17,5	0,13
18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
19,5	6.188,0	0,06	19,5	0,09
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

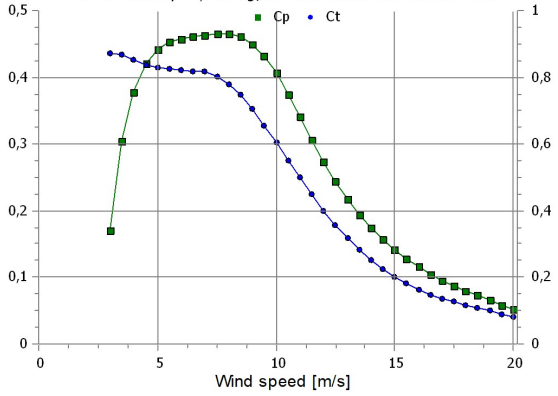
Data used in calculation, Air density: 1,186 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,0	0,17	2,50- 3,50	62,5	62,5	0,3
4,0	345,4	0,38	3,50- 4,50	288,3	350,7	1,5
5,0	787,7	0,44	4,50- 5,50	719,4	1.070,2	4,5
6,0	1.412,0	0,46	5,50- 6,50	1.345,8	2.415,9	10,0
7,0	2.270,5	0,46	6,50- 7,50	2.109,4	4.525,3	18,8
8,0	3.399,0	0,47	7,50- 8,50	2.872,3	7.397,6	30,8
9,0	4.674,1	0,45	8,50- 9,50	3.386,9	10.784,5	44,9
10,0	5.800,4	0,41	9,50-10,50	3.411,8	14.196,3	59,1
11,0	6.459,9	0,34	10,50-11,50	2.960,0	17.156,3	71,4
12,0	6.744,8	0,27	11,50-12,50	2.287,0	19.443,2	80,9
13,0	6.800,0	0,22	12,50-13,50	1.634,4	21.077,6	87,7
14,0	6.799,6	0,17	13,50-14,50	1.113,0	22.190,7	92,3
15,0	6.790,2	0,14	14,50-15,50	735,7	22.926,4	95,4
16,0	6.758,7	0,12	15,50-16,50	474,8	23.401,2	97,3
17,0	6.709,3	0,10	16,50-17,50	300,3	23.701,4	98,6
18,0	6.644,0	0,08	17,50-18,50	186,5	23.887,9	99,4
19,0	6.419,0	0,07	18,50-19,50	111,9	23.999,8	99,8
20,0	5.882,0	0,05	19,50-20,50	41,0	24.040,8	100,0

Power curve
For air density: 1,186 kg/m³ and reference climate data



Cp and Ct curve
For air density: 1,186 kg/m³ and reference climate data



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
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PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 2 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
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Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
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4,5	567,0	0,42	4,5	0,84
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6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
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18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
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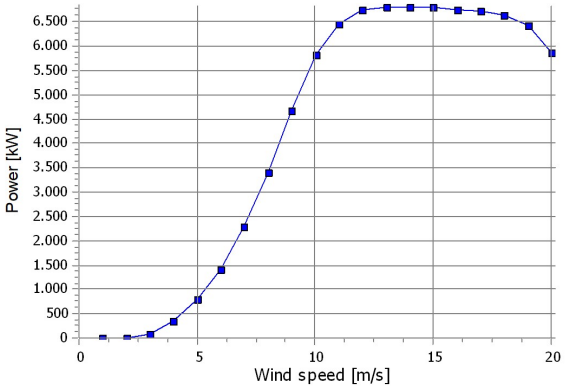
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

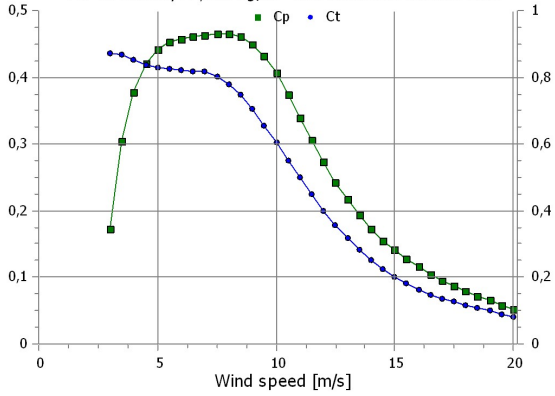
Data used in calculation, Air density: 1,189 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,5	0,17	2,50- 3,50	67,0	67,0	0,3
4,0	346,4	0,38	3,50- 4,50	306,0	373,0	1,7
5,0	789,5	0,44	4,50- 5,50	754,1	1.127,1	5,0
6,0	1.415,0	0,46	5,50- 6,50	1.388,5	2.515,6	11,2
7,0	2.275,4	0,46	6,50- 7,50	2.135,3	4.650,9	20,7
8,0	3.406,3	0,47	7,50- 8,50	2.844,3	7.495,2	33,3
9,0	4.683,4	0,45	8,50- 9,50	3.272,0	10.767,2	47,9
10,0	5.809,5	0,41	9,50-10,50	3.207,8	13.975,0	62,1
11,0	6.465,7	0,34	10,50-11,50	2.702,9	16.677,9	74,2
12,0	6.747,1	0,27	11,50-12,50	2.025,9	18.703,8	83,2
13,0	6.800,0	0,22	12,50-13,50	1.404,5	20.108,3	89,4
14,0	6.799,5	0,17	13,50-14,50	928,9	21.037,1	93,5
15,0	6.789,9	0,14	14,50-15,50	597,0	21.634,2	96,2
16,0	6.757,9	0,12	15,50-16,50	375,1	22.009,3	97,9
17,0	6.708,0	0,10	16,50-17,50	231,2	22.240,5	98,9
18,0	6.644,0	0,08	17,50-18,50	139,9	22.380,4	99,5
19,0	6.419,0	0,07	18,50-19,50	81,8	22.462,3	99,9
20,0	5.882,0	0,05	19,50-20,50	29,5	22.491,7	100,0

Power curve
For air density: 1,189 kg/m³ and reference climate data



Cp and Ct curve
For air density: 1,189 kg/m³ and reference climate data



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 3 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	12.057	18.161	23.973	29.087	33.362	36.754
NORDEX N175-6.X-Mode 0 6800 175.0 !-! N175-6.X-Mode 3 HH179m	[MWh]	12.229	18.323	24.017	28.750	32.245	34.466
Check value	[%]	-1	-1	0	1	3	7

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

Original data, Air density: 1,225 kg/m³

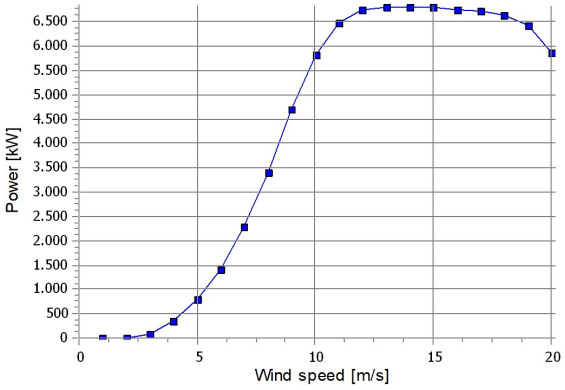
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
3,0	74,0	0,19	3,0	0,87
3,5	195,0	0,31	3,5	0,87
4,0	360,0	0,38	4,0	0,85
4,5	567,0	0,42	4,5	0,84
5,0	815,0	0,44	5,0	0,83
5,5	1.110,0	0,45	5,5	0,82
6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
17,0	6.691,0	0,09	17,0	0,14
17,5	6.671,0	0,08	17,5	0,13
18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
19,5	6.188,0	0,06	19,5	0,09
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

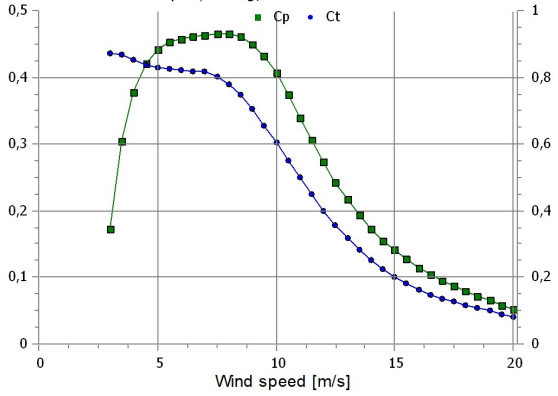
Data used in calculation, Air density: 1,190 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,8	0,17	2,50- 3,50	68,8	68,8	0,3
4,0	346,9	0,38	3,50- 4,50	313,2	382,0	1,7
5,0	790,5	0,44	4,50- 5,50	768,0	1.150,0	5,2
6,0	1.416,7	0,46	5,50- 6,50	1.406,4	2.556,4	11,5
7,0	2.278,1	0,46	6,50- 7,50	2.149,8	4.706,2	21,2
8,0	3.410,2	0,47	7,50- 8,50	2.844,5	7.550,7	34,0
9,0	4.688,3	0,45	8,50- 9,50	3.249,3	10.800,0	48,6
10,0	5.814,4	0,41	9,50-10,50	3.162,5	13.962,5	62,8
11,0	6.468,7	0,34	10,50-11,50	2.645,7	16.608,2	74,7
12,0	6.748,3	0,27	11,50-12,50	1.970,2	18.578,4	83,5
13,0	6.800,0	0,22	12,50-13,50	1.358,8	19.937,2	89,6
14,0	6.799,5	0,17	13,50-14,50	895,6	20.832,7	93,7
15,0	6.789,8	0,14	14,50-15,50	575,0	21.407,8	96,3
16,0	6.757,4	0,12	15,50-16,50	361,9	21.769,7	97,9
17,0	6.707,4	0,10	16,50-17,50	224,1	21.993,8	98,9
18,0	6.644,0	0,08	17,50-18,50	136,6	22.130,4	99,5
19,0	6.419,0	0,07	18,50-19,50	80,7	22.211,1	99,9
20,0	5.882,0	0,05	19,50-20,50	29,3	22.240,3	100,0

Power curve
For air density: 1,190 kg/m³ and reference climate data



Cp and Ct curve
For air density: 1,190 kg/m³ and reference climate data



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 4 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	12.057	18.161	23.973	29.087	33.362	36.754
NORDEX N175-6.X-Mode 0 6800 175.0 !-! N175-6.X-Mode 3 HH179m	[MWh]	12.229	18.323	24.017	28.750	32.245	34.466
Check value	[%]	-1	-1	0	1	3	7

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

Original data, Air density: 1,225 kg/m³

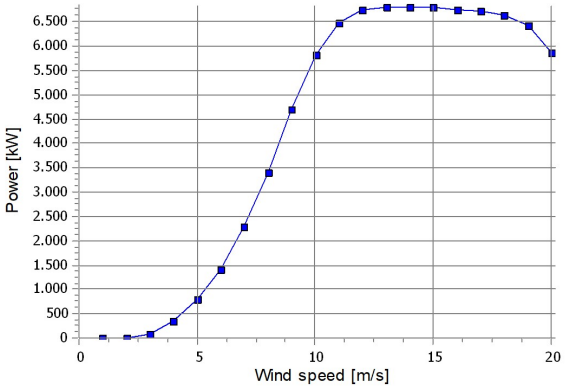
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
3,0	74,0	0,19	3,0	0,87
3,5	195,0	0,31	3,5	0,87
4,0	360,0	0,38	4,0	0,85
4,5	567,0	0,42	4,5	0,84
5,0	815,0	0,44	5,0	0,83
5,5	1.110,0	0,45	5,5	0,82
6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
17,0	6.691,0	0,09	17,0	0,14
17,5	6.671,0	0,08	17,5	0,13
18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
19,5	6.188,0	0,06	19,5	0,09
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

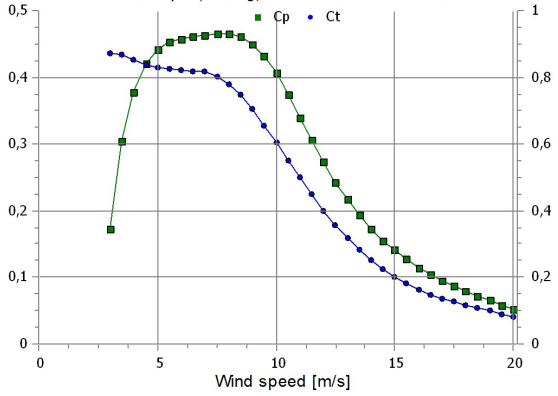
Data used in calculation, Air density: 1,190 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,8	0,17	2,50- 3,50	68,0	68,0	0,3
4,0	347,0	0,38	3,50- 4,50	310,2	378,2	1,6
5,0	790,5	0,44	4,50- 5,50	763,9	1.142,1	5,0
6,0	1.416,8	0,46	5,50- 6,50	1.406,7	2.548,9	11,1
7,0	2.278,2	0,46	6,50- 7,50	2.165,5	4.714,4	20,5
8,0	3.410,5	0,47	7,50- 8,50	2.889,6	7.604,0	33,1
9,0	4.688,7	0,45	8,50- 9,50	3.331,9	10.935,9	47,6
10,0	5.814,7	0,41	9,50-10,50	3.275,0	14.210,9	61,9
11,0	6.468,9	0,34	10,50-11,50	2.767,1	16.978,0	73,9
12,0	6.748,4	0,27	11,50-12,50	2.079,8	19.057,8	83,0
13,0	6.800,0	0,22	12,50-13,50	1.445,7	20.503,5	89,3
14,0	6.799,5	0,17	13,50-14,50	958,5	21.462,0	93,4
15,0	6.789,7	0,14	14,50-15,50	617,6	22.079,6	96,1
16,0	6.757,4	0,12	15,50-16,50	389,0	22.468,6	97,8
17,0	6.707,4	0,10	16,50-17,50	240,6	22.709,2	98,9
18,0	6.644,0	0,08	17,50-18,50	146,2	22.855,4	99,5
19,0	6.419,0	0,07	18,50-19,50	86,0	22.941,4	99,9
20,0	5.882,0	0,05	19,50-20,50	31,1	22.972,5	100,0

Power curve
For air density: 1,190 kg/m³ and reference climate data



Cp and Ct curve
For air density: 1,190 kg/m³ and reference climate data



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 5 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	12.057	18.161	23.973	29.087	33.362	36.754
NORDEX N175-6.X-Mode 0 6800 175.0 !-! N175-6.X-Mode 3 HH179m	[MWh]	12.229	18.323	24.017	28.750	32.245	34.466
Check value	[%]	-1	-1	0	1	3	7

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

Original data, Air density: 1,225 kg/m³

Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
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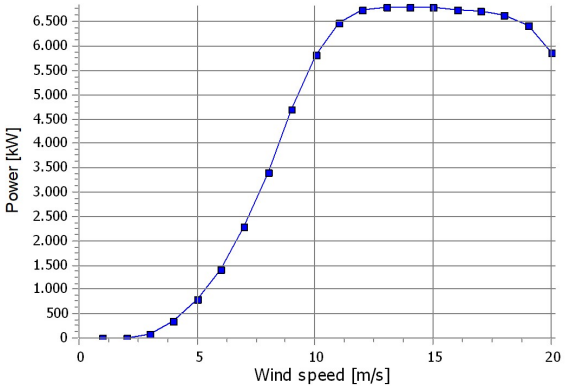
4,0	360,0	0,38	4,0	0,85
4,5	567,0	0,42	4,5	0,84
5,0	815,0	0,44	5,0	0,83
5,5	1.110,0	0,45	5,5	0,82
6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
17,0	6.691,0	0,09	17,0	0,14
17,5	6.671,0	0,08	17,5	0,13
18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
19,5	6.188,0	0,06	19,5	0,09
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

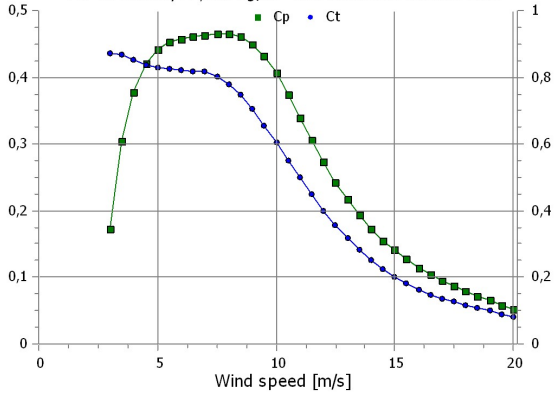
Data used in calculation, Air density: 1,190 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,8	0,17	2,50- 3,50	67,7	67,7	0,3
4,0	346,9	0,38	3,50- 4,50	309,1	376,8	1,6
5,0	790,5	0,44	4,50- 5,50	760,9	1.137,7	4,9
6,0	1.416,7	0,46	5,50- 6,50	1.401,3	2.539,1	11,0
7,0	2.278,1	0,46	6,50- 7,50	2.158,4	4.697,5	20,4
8,0	3.410,2	0,47	7,50- 8,50	2.883,2	7.580,6	32,9
9,0	4.688,3	0,45	8,50- 9,50	3.330,2	10.910,8	47,3
10,0	5.814,4	0,41	9,50-10,50	3.281,4	14.192,3	61,5
11,0	6.468,7	0,34	10,50-11,50	2.781,7	16.974,0	73,6
12,0	6.748,3	0,27	11,50-12,50	2.099,6	19.073,6	82,7
13,0	6.800,0	0,22	12,50-13,50	1.466,7	20.540,3	89,0
14,0	6.799,5	0,17	13,50-14,50	977,7	21.518,0	93,3
15,0	6.789,8	0,14	14,50-15,50	633,3	22.151,4	96,0
16,0	6.757,4	0,12	15,50-16,50	400,9	22.552,3	97,7
17,0	6.707,4	0,10	16,50-17,50	248,9	22.801,2	98,8
18,0	6.644,0	0,08	17,50-18,50	151,7	22.952,9	99,5
19,0	6.419,0	0,07	18,50-19,50	89,3	23.042,2	99,9
20,0	5.882,0	0,05	19,50-20,50	32,3	23.074,5	100,0

Power curve
For air density: 1,190 kg/m³ and reference climate data



Cp and Ct curve
For air density: 1,190 kg/m³ and reference climate data



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 6 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	12.057	18.161	23.973	29.087	33.362	36.754
NORDEX N175-6.X-Mode 0 6800 175.0 !-! N175-6.X-Mode 3 HH179m	[MWh]	12.229	18.323	24.017	28.750	32.245	34.466
Check value	[%]	-1	-1	0	1	3	7

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

Original data, Air density: 1,225 kg/m³

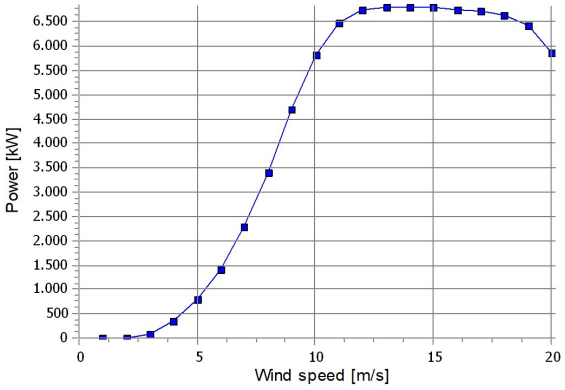
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
3,0	74,0	0,19	3,0	0,87
3,5	195,0	0,31	3,5	0,87
4,0	360,0	0,38	4,0	0,85
4,5	567,0	0,42	4,5	0,84
5,0	815,0	0,44	5,0	0,83
5,5	1.110,0	0,45	5,5	0,82
6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
17,0	6.691,0	0,09	17,0	0,14
17,5	6.671,0	0,08	17,5	0,13
18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
19,5	6.188,0	0,06	19,5	0,09
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

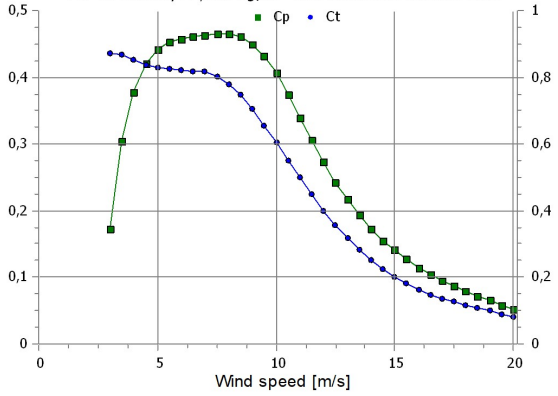
Data used in calculation, Air density: 1,190 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,9	0,17	2,50- 3,50	70,6	70,6	0,3
4,0	347,0	0,38	3,50- 4,50	321,7	392,3	1,7
5,0	790,6	0,44	4,50- 5,50	789,9	1.182,2	5,1
6,0	1.416,9	0,46	5,50- 6,50	1.449,4	2.631,6	11,4
7,0	2.278,4	0,46	6,50- 7,50	2.221,0	4.852,6	21,0
8,0	3.410,8	0,47	7,50- 8,50	2.947,1	7.799,7	33,8
9,0	4.689,0	0,45	8,50- 9,50	3.375,9	11.175,5	48,4
10,0	5.815,0	0,41	9,50-10,50	3.293,7	14.469,2	62,7
11,0	6.469,1	0,34	10,50-11,50	2.760,2	17.229,5	74,6
12,0	6.748,5	0,27	11,50-12,50	2.056,9	19.286,4	83,5
13,0	6.800,0	0,22	12,50-13,50	1.417,8	20.704,2	89,7
14,0	6.799,5	0,17	13,50-14,50	932,8	21.636,9	93,7
15,0	6.789,7	0,14	14,50-15,50	597,2	22.234,1	96,3
16,0	6.757,4	0,12	15,50-16,50	374,4	22.608,5	97,9
17,0	6.707,3	0,10	16,50-17,50	230,9	22.839,4	98,9
18,0	6.644,0	0,08	17,50-18,50	140,2	22.979,6	99,5
19,0	6.419,0	0,07	18,50-19,50	82,5	23.062,1	99,9
20,0	5.882,0	0,05	19,50-20,50	29,8	23.091,9	100,0

Power curve
For air density: 1,190 kg/m³ and reference climate data



Cp and Ct curve
For air density: 1,190 kg/m³ and reference climate data



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Power Curve Analysis

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m WTG: 7 - NORDEX N175-6.X-Mode 0 6800 175.0 !-!, Hub height: 125,0 m

Name: N175-6.X-Mode 3 HH179m
Source: F008_278_A12_EN

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
11/09/2023	USER	11/09/2023	11/09/2023	20,0	Pitch	User defined	Variable	0,28

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	12.057	18.161	23.973	29.087	33.362	36.754
NORDEX N175-6.X-Mode 0 6800 175.0 !-! N175-6.X-Mode 3 HH179m	[MWh]	12.229	18.323	24.017	28.750	32.245	34.466
Check value	[%]	-1	-1	0	1	3	7

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

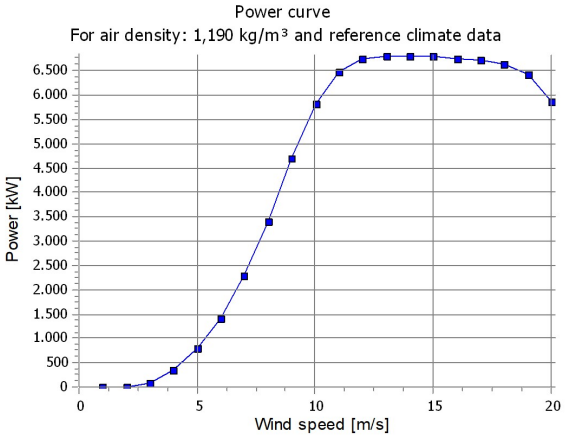
Original data, Air density: 1,225 kg/m³

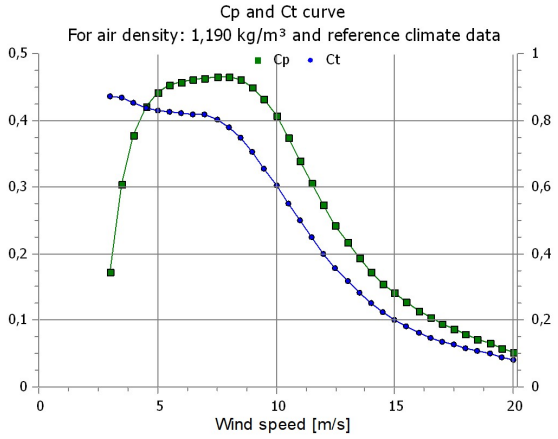
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
3,0	74,0	0,19	3,0	0,87
3,5	195,0	0,31	3,5	0,87
4,0	360,0	0,38	4,0	0,85
4,5	567,0	0,42	4,5	0,84
5,0	815,0	0,44	5,0	0,83
5,5	1.110,0	0,45	5,5	0,82
6,0	1.458,0	0,46	6,0	0,82
6,5	1.868,0	0,46	6,5	0,82
7,0	2.344,0	0,46	7,0	0,82
7,5	2.891,0	0,47	7,5	0,80
8,0	3.509,0	0,47	8,0	0,78
8,5	4.163,0	0,46	8,5	0,75
9,0	4.815,0	0,45	9,0	0,71
9,5	5.437,0	0,43	9,5	0,66
10,0	5.940,0	0,40	10,0	0,61
10,5	6.304,0	0,37	10,5	0,55
11,0	6.549,0	0,33	11,0	0,50
11,5	6.703,0	0,30	11,5	0,45
12,0	6.780,0	0,27	12,0	0,40
12,5	6.800,0	0,24	12,5	0,36
13,0	6.800,0	0,21	13,0	0,32
13,5	6.800,0	0,19	13,5	0,28
14,0	6.799,0	0,17	14,0	0,25
14,5	6.793,0	0,15	14,5	0,23
15,0	6.786,0	0,14	15,0	0,20
15,5	6.766,0	0,12	15,5	0,18
16,0	6.746,0	0,11	16,0	0,16
16,5	6.718,0	0,10	16,5	0,15
17,0	6.691,0	0,09	17,0	0,14
17,5	6.671,0	0,08	17,5	0,13
18,0	6.644,0	0,08	18,0	0,12
18,5	6.576,0	0,07	18,5	0,11
19,0	6.419,0	0,06	19,0	0,10
19,5	6.188,0	0,06	19,5	0,09
20,0	5.882,0	0,05	20,0	0,08

Power, Efficiency and energy vs. wind speed

Data used in calculation, Air density: 1,190 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1,0	0,0	0,00	0,50- 1,50	0,0	0,0	0,0
2,0	0,0	0,00	1,50- 2,50	0,0	0,0	0,0
3,0	66,8	0,17	2,50- 3,50	69,9	69,9	0,3
4,0	346,9	0,38	3,50- 4,50	318,4	388,3	1,7
5,0	790,5	0,44	4,50- 5,50	783,0	1.171,3	5,0
6,0	1.416,7	0,46	5,50- 6,50	1.440,0	2.611,3	11,2
7,0	2.278,1	0,46	6,50- 7,50	2.213,7	4.825,0	20,6
8,0	3.410,2	0,47	7,50- 8,50	2.949,4	7.774,4	33,3
9,0	4.688,3	0,45	8,50- 9,50	3.395,0	11.169,3	47,8
10,0	5.814,4	0,41	9,50-10,50	3.330,6	14.499,9	62,1
11,0	6.468,7	0,34	10,50-11,50	2.807,9	17.307,9	74,1
12,0	6.748,3	0,27	11,50-12,50	2.105,5	19.413,3	83,1
13,0	6.800,0	0,22	12,50-13,50	1.460,1	20.873,5	89,3
14,0	6.799,5	0,17	13,50-14,50	966,2	21.839,7	93,5
15,0	6.789,8	0,14	14,50-15,50	622,0	22.461,7	96,1
16,0	6.757,4	0,12	15,50-16,50	392,2	22.853,9	97,8
17,0	6.707,4	0,10	16,50-17,50	243,4	23.097,3	98,8
18,0	6.644,0	0,08	17,50-18,50	148,9	23.246,3	99,5
19,0	6.419,0	0,07	18,50-19,50	88,4	23.334,6	99,9
20,0	5.882,0	0,05	19,50-20,50	32,2	23.366,8	100,0





Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Time varying AEP

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m

Windfarm: 47,6 MW based on 7 turbines of type NORDEX N175-6.X-Mode 0 6800 175.0 !-!.
Selection: All new WTGs
Calculated mean yield per month and hour [MWh]. El resultado incluye las pérdidas por estela y una reducción de 9,2 %
Values are scaled to a full year, see correction factors at main result page.
Used wind distribution: VORTEX-Data-AEG-03 - 125.00 m. 17/02/2020 - 17/02/2021 (366 days), 30 minutes, 100%

Hour/Month [MWh]	1	2	3	4	5	6	7	8	9	10	11	12	Grand Total
0	672	715	671	631	639	509	395	577	686	533	537	637	7.202
1	634	709	687	655	603	533	414	565	567	553	505	628	7.054
2	653	718	712	659	574	504	400	528	486	572	517	614	6.937
3	686	723	681	673	567	469	402	476	502	558	494	635	6.867
4	698	683	649	679	534	436	430	430	508	568	478	678	6.773
5	702	674	646	638	535	393	438	389	514	577	476	697	6.680
6	702	689	655	603	493	348	436	380	513	581	513	698	6.611
7	683	654	631	578	451	312	374	388	479	576	504	680	6.308
8	671	598	609	509	391	198	231	345	436	556	481	691	5.715
9	679	570	554	388	285	144	103	207	281	491	503	691	4.895
10	657	447	417	361	314	160	94	134	175	402	474	661	4.295
11	566	322	433	396	415	206	94	118	216	293	365	573	3.997
12	503	347	451	457	466	284	115	142	220	271	280	455	3.993
13	481	420	488	531	535	402	159	183	246	290	318	451	4.504
14	482	519	539	551	607	496	226	257	302	318	378	440	5.115
15	524	545	561	603	654	525	234	313	328	356	399	458	5.500
16	541	533	603	608	661	528	233	341	350	393	398	454	5.644
17	560	531	609	637	615	550	227	358	386	415	387	449	5.724
18	603	556	613	648	599	578	237	409	411	406	397	495	5.953
19	653	662	654	653	642	583	272	488	491	453	436	576	6.563
20	678	703	702	639	689	613	358	583	606	504	513	640	7.230
21	708	754	690	606	734	645	384	587	692	548	570	669	7.586
22	719	763	702	609	738	601	399	569	719	589	621	676	7.706
23	709	747	692	628	681	540	417	598	706	555	633	683	7.590
Grand Total	15.164	14.583	14.650	13.939	13.422	10.559	7.072	9.366	10.823	11.358	11.178	14.328	146.441

Hour/Month [MW]	1	2	3	4	5	6	7	8	9	10	11	12	Grand Total
0	21,7	25,5	21,7	21,0	20,6	17,0	12,7	18,6	22,9	17,2	17,9	20,5	19,7
1	20,5	25,3	22,2	21,8	19,4	17,8	13,4	18,2	18,9	17,8	16,8	20,3	19,3
2	21,1	25,7	23,0	22,0	18,5	16,8	12,9	17,0	16,2	18,5	17,2	19,8	19,0
3	22,1	25,8	22,0	22,4	18,3	15,6	13,0	15,3	16,7	18,0	16,5	20,5	18,8
4	22,5	24,4	20,9	22,6	17,2	14,5	13,9	13,9	16,9	18,3	15,9	21,9	18,6
5	22,6	24,1	20,8	21,3	17,3	13,1	14,1	12,6	17,1	18,6	15,9	22,5	18,3
6	22,6	24,6	21,1	20,1	15,9	11,6	14,1	12,3	17,1	18,7	17,1	22,5	18,1
7	22,0	23,3	20,4	19,3	14,5	10,4	12,1	12,5	16,0	18,6	16,8	21,9	17,3
8	21,6	21,4	19,6	17,0	12,6	6,6	7,4	11,1	14,5	17,9	16,0	22,3	15,7
9	21,9	20,4	17,9	12,9	9,2	4,8	3,3	6,7	9,4	15,8	16,8	22,3	13,4
10	21,2	16,0	13,4	12,0	10,1	5,3	3,0	4,3	5,8	13,0	15,8	21,3	11,8
11	18,2	11,5	14,0	13,2	13,4	6,9	3,0	3,8	7,2	9,5	12,2	18,5	11,0
12	16,2	12,4	14,6	15,2	15,0	9,5	3,7	4,6	7,3	8,8	9,3	14,7	10,9
13	15,5	15,0	15,8	17,7	17,2	13,4	5,1	5,9	8,2	9,4	10,6	14,5	12,3
14	15,6	18,5	17,4	18,4	19,6	16,5	7,3	8,3	10,1	10,2	12,6	14,2	14,0
15	16,9	19,5	18,1	20,1	21,1	17,5	7,5	10,1	10,9	11,5	13,3	14,8	15,1
16	17,5	19,0	19,4	20,3	21,3	17,6	7,5	11,0	11,7	12,7	13,3	14,7	15,5
17	18,1	19,0	19,6	21,2	19,8	18,3	7,3	11,6	12,9	13,4	12,9	14,5	15,7
18	19,4	19,9	19,8	21,6	19,3	19,3	7,7	13,2	13,7	13,1	13,2	16,0	16,3
19	21,1	23,6	21,1	21,8	20,7	19,4	8,8	15,7	16,4	14,6	14,5	18,6	18,0
20	21,9	25,1	22,7	21,3	22,2	20,4	11,5	18,8	20,2	16,3	17,1	20,6	19,8
21	22,8	26,9	22,3	20,2	23,7	21,5	12,4	18,9	23,1	17,7	19,0	21,6	20,8
22	23,2	27,3	22,6	20,3	23,8	20,0	12,9	18,3	24,0	19,0	20,7	21,8	21,1
23	22,9	26,7	22,3	20,9	22,0	18,0	13,4	19,3	23,5	17,9	21,1	22,0	20,8
Grand Total	20,4	21,7	19,7	19,4	18,0	14,7	9,5	12,6	15,0	15,3	15,5	19,3	16,7

Project:
14070_PE Los Morales

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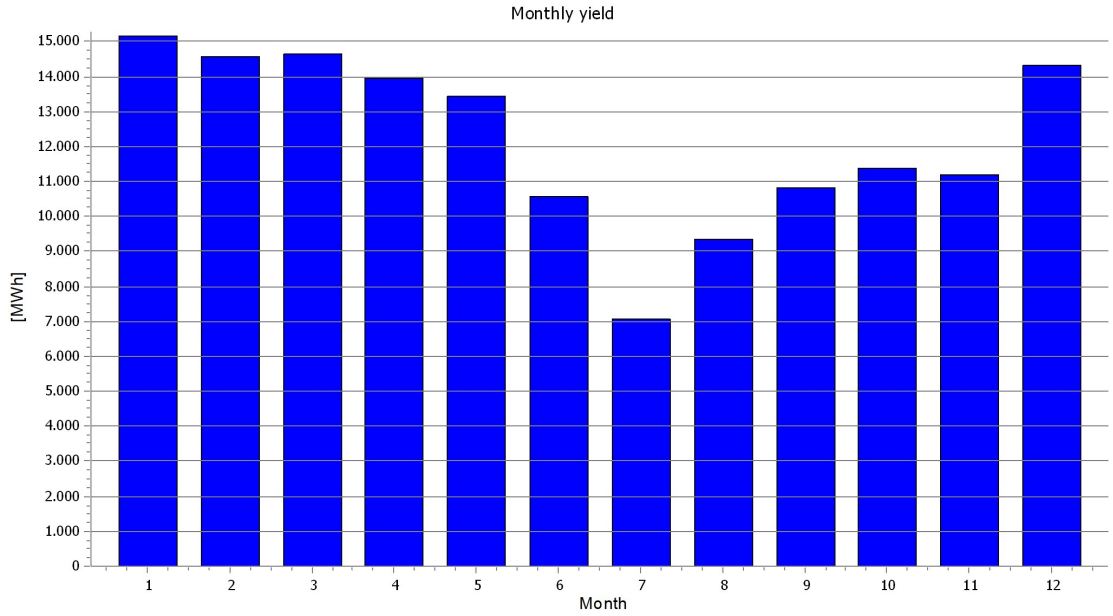
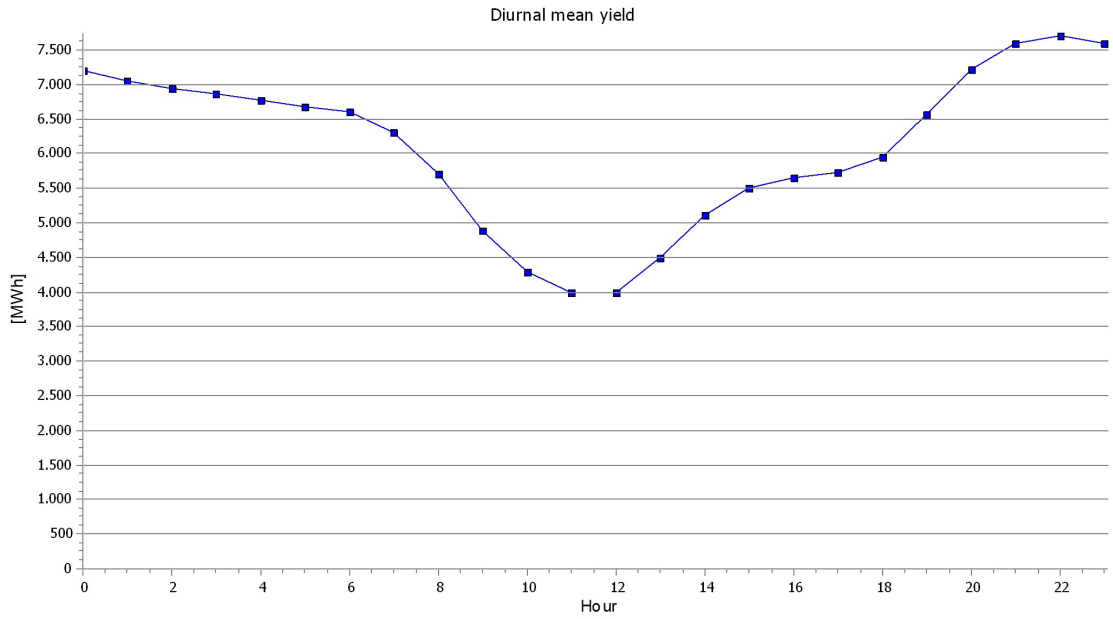
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Time varying AEP

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m

Windfarm: 47,6 MW based on 7 turbines of type NORDEX N175-6.X-Mode 0 6800 175.0 !-!.
Selection: All new WTGs
Calculated mean yield per month and hour [MWh]. El resultado incluye las pérdidas por estela y una reducción de 9,2 %
Values are scaled to a full year, see correction factors at main result page.
Used wind distribution: VORTEX-Data-AEG-03 - 125.00 m. 17/02/2020 - 17/02/2021 (366 days), 30 minutes, 100%





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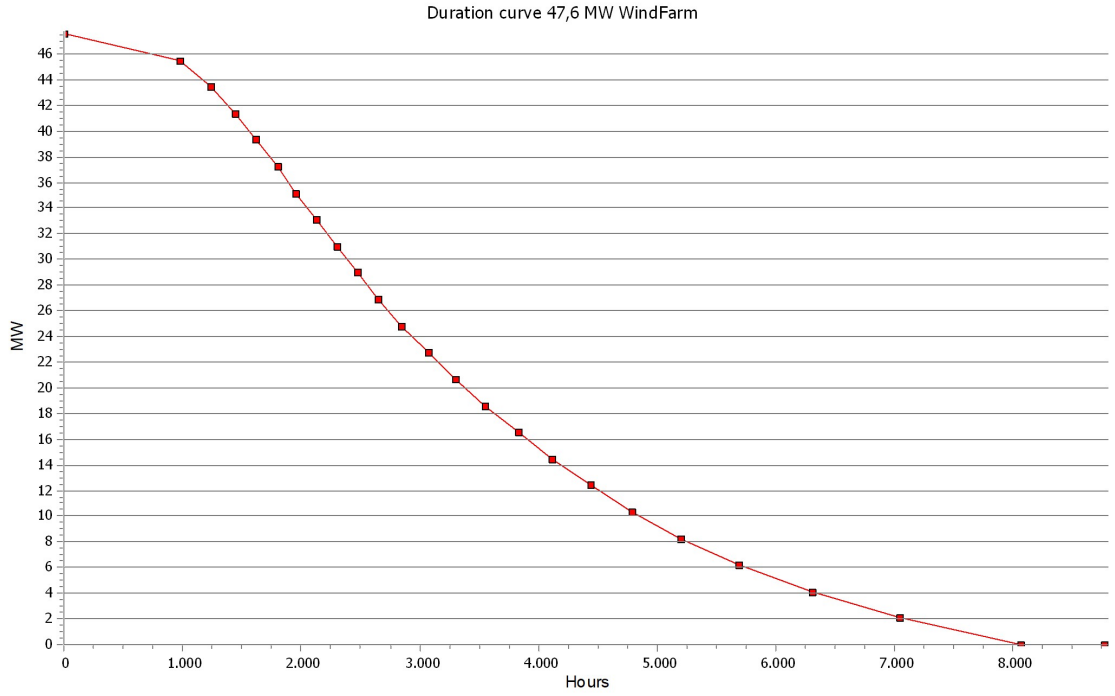
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Time varying AEP

Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m

Windfarm: 47,6 MW based on 7 turbines of type NORDEX N175-6.X-Mode 0 6800 175.0 !-!.
Selection: All new WTGs
Used wind distribution: VORTEX-Data-AEG-03 - 125.00 m. 17/02/2020 - 17/02/2021 (366 days), 30 minutes, 100%

Hours	Hours [%]	Hours accumulated	Power [MW]	Power (MW/WTG)
0	0,0	0	47,6	6,8
980	11,2	980	45,5 - 47,6	6,5 - 6,8
256	2,9	1237	43,5 - 45,5	6,2 - 6,5
209	2,4	1446	41,4 - 43,5	5,9 - 6,2
173	2,0	1618	39,3 - 41,4	5,6 - 5,9
178	2,0	1796	37,3 - 39,3	5,3 - 5,6
160	1,8	1956	35,2 - 37,3	5,0 - 5,3
173	2,0	2129	33,1 - 35,2	4,7 - 5,0
168	1,9	2297	31,0 - 33,1	4,4 - 4,7
176	2,0	2473	29,0 - 31,0	4,1 - 4,4
170	1,9	2643	26,9 - 29,0	3,8 - 4,1
198	2,3	2841	24,8 - 26,9	3,5 - 3,8
229	2,6	3069	22,8 - 24,8	3,3 - 3,5
231	2,6	3300	20,7 - 22,8	3,0 - 3,3
253	2,9	3553	18,6 - 20,7	2,7 - 3,0
280	3,2	3833	16,6 - 18,6	2,4 - 2,7
282	3,2	4115	14,5 - 16,6	2,1 - 2,4
319	3,6	4435	12,4 - 14,5	1,8 - 2,1
349	4,0	4784	10,3 - 12,4	1,5 - 1,8
408	4,7	5192	8,3 - 10,3	1,2 - 1,5
490	5,6	5681	6,2 - 8,3	0,9 - 1,2
624	7,1	6305	4,1 - 6,2	0,6 - 0,9
740	8,4	7044	2,1 - 4,1	0,3 - 0,6
1014	11,6	8059	0,0 - 2,1	0,0 - 0,3
707	8,1	8766	0,0	0,0



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Wind Data Analysis

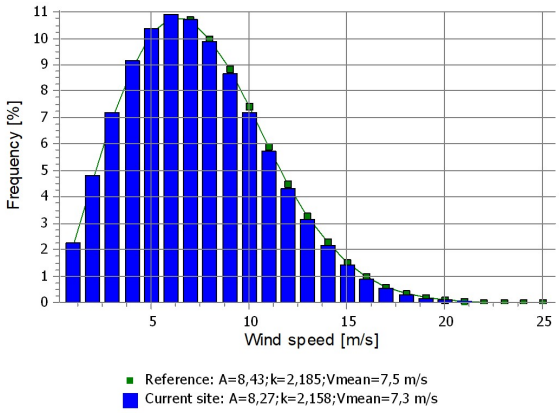
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

Site coordinates
UTM (north)-WGS84 Zone: 29
East: 744.393 North: 4.066.559
AEG-01
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

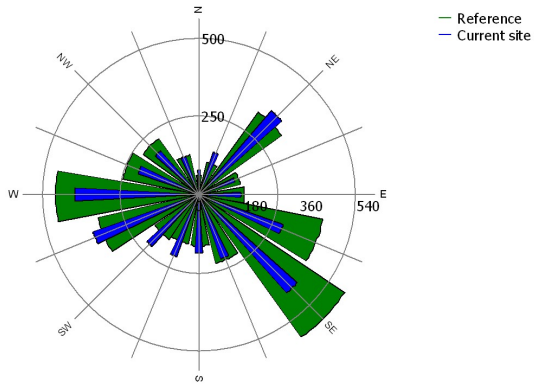
Weibull Data

Sector	Current site A-parameter [m/s]	Current site Wind speed [m/s]	Current site k-parameter	Current site Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	Reference: Roughness class 1 k-parameter	Reference: Roughness class 1 Frequency [%]
0 N	6,59	5,83	2,135	4,2	6,26	2,112	3,9
1 NNE	7,52	6,66	2,279	5,5	7,11	2,437	5,0
2 NE	9,63	8,53	2,150	6,1	9,50	2,170	5,9
3 ENE	7,77	6,89	2,549	4,6	8,09	2,524	4,5
4 E	7,71	6,83	2,424	5,0	8,09	2,690	5,0
5 ESE	9,25	8,20	2,369	6,0	10,18	2,405	6,5
6 SE	10,08	8,93	2,146	6,4	10,81	2,164	6,9
7 SSE	8,75	7,75	2,186	5,1	8,93	2,243	5,1
8 S	8,34	7,39	2,084	4,8	8,16	2,097	4,6
9 SSW	7,86	6,98	1,830	5,6	7,34	1,831	5,3
10 SW	7,74	6,90	1,760	5,9	7,36	1,736	5,2
11 WSW	8,29	7,34	2,154	9,7	8,14	2,155	9,5
12 W	8,41	7,46	2,514	11,6	8,65	2,559	12,5
13 WNW	7,68	6,82	2,545	8,0	8,03	2,589	8,5
14 NW	8,02	7,13	2,686	6,5	8,34	2,725	6,9
15 NNW	7,65	6,78	2,424	4,9	7,70	2,424	4,8
All	8,27	7,33	2,158	100,0	8,43	2,185	100,0

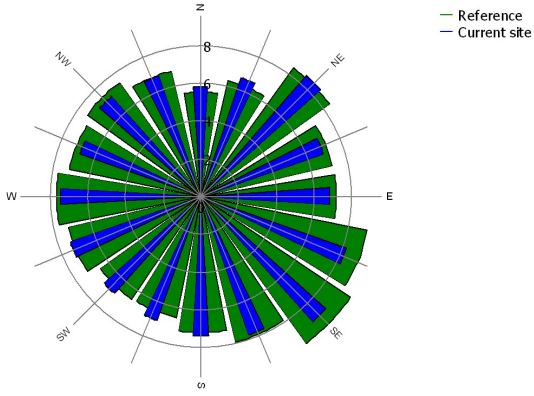
Weibull Distribution



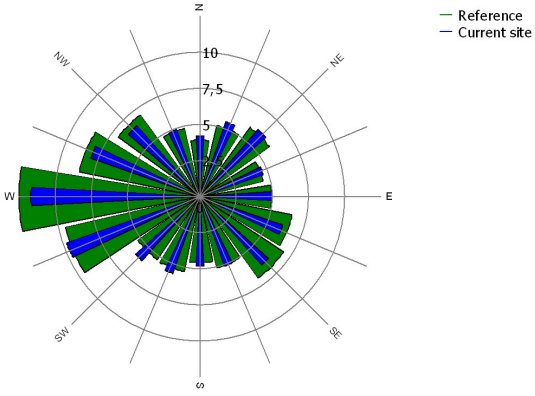
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Wind Data Analysis

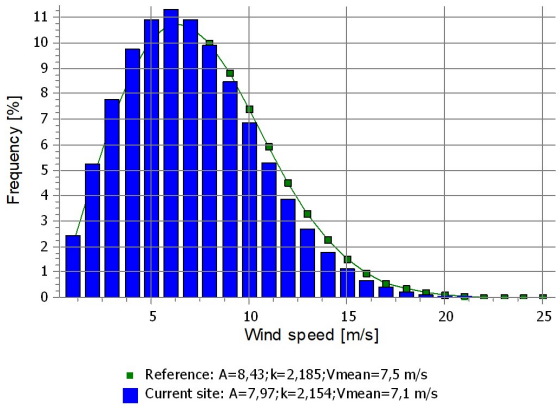
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

Site coordinates
UTM (north)-WGS84 Zone: 29
East: 744.462 North: 4.066.039
AEG-02
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

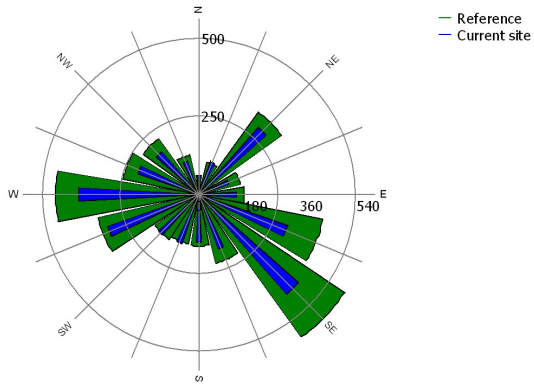
Weibull Data

Sector	Current site A-parameter [m/s]	Wind speed [m/s]	k-parameter	Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	k-parameter	Frequency [%]
0 N	6,15	5,45	2,123	4,0	6,26	2,112	3,9
1 NNE	7,03	6,23	2,303	5,2	7,11	2,437	5,0
2 NE	9,06	8,02	2,154	6,0	9,50	2,170	5,9
3 ENE	7,30	6,49	2,557	4,6	8,09	2,524	4,5
4 E	7,39	6,55	2,424	5,1	8,09	2,690	5,0
5 ESE	9,26	8,21	2,377	6,3	10,18	2,405	6,5
6 SE	9,96	8,82	2,146	6,6	10,81	2,164	6,9
7 SSE	8,33	7,38	2,205	5,0	8,93	2,243	5,1
8 S	7,85	6,96	2,076	4,7	8,16	2,097	4,6
9 SSW	7,35	6,54	1,826	5,4	7,34	1,831	5,3
10 SW	7,24	6,45	1,732	5,5	7,36	1,736	5,2
11 WSW	7,92	7,01	2,131	9,5	8,14	2,155	9,5
12 W	8,22	7,29	2,514	12,1	8,65	2,559	12,5
13 WNW	7,57	6,72	2,549	8,3	8,03	2,589	8,5
14 NW	7,86	6,99	2,689	6,8	8,34	2,725	6,9
15 NNW	7,33	6,50	2,404	4,8	7,70	2,424	4,8
All	7,97	7,06	2,154	100,0	8,43	2,185	100,0

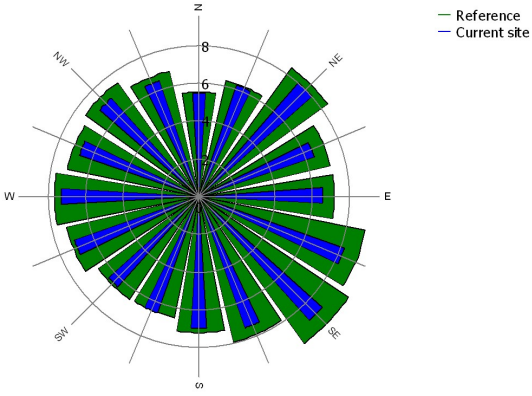
Weibull Distribution



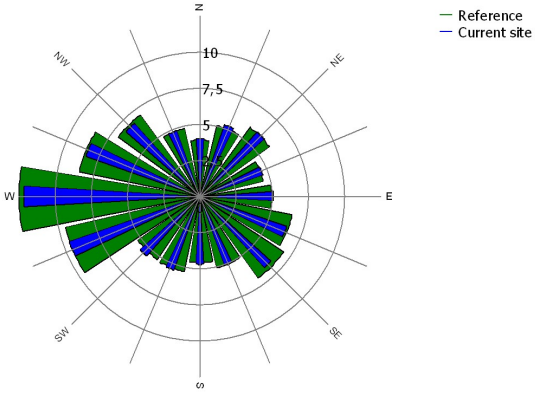
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Wind Data Analysis

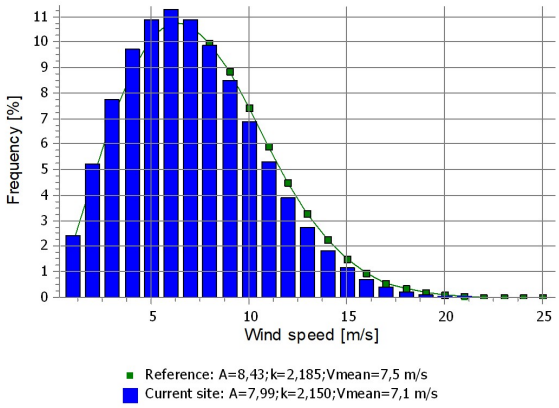
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

Site coordinates
UTM (north)-WGS84 Zone: 29
East: 743.040 North: 4.066.633
AEG-04
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

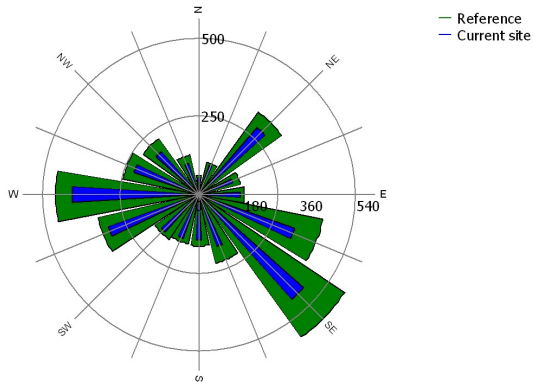
Weibull Data

Sector	Current site A-parameter [m/s]	Wind speed [m/s]	k-parameter	Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	k-parameter	Frequency [%]
0 N	5,98	5,30	2,119	3,9	6,26	2,112	3,9
1 NNE	6,85	6,07	2,322	5,1	7,11	2,437	5,0
2 NE	9,06	8,02	2,154	5,9	9,50	2,170	5,9
3 ENE	7,61	6,75	2,541	4,6	8,09	2,524	4,5
4 E	7,60	6,74	2,463	5,2	8,09	2,690	5,0
5 ESE	9,40	8,33	2,369	6,5	10,18	2,405	6,5
6 SE	10,07	8,92	2,143	6,7	10,81	2,164	6,9
7 SSE	8,26	7,31	2,225	4,9	8,93	2,243	5,1
8 S	7,80	6,91	2,076	4,5	8,16	2,097	4,6
9 SSW	7,15	6,36	1,822	5,2	7,34	1,831	5,3
10 SW	7,12	6,35	1,717	5,3	7,36	1,736	5,2
11 WSW	7,90	7,00	2,107	9,4	8,14	2,155	9,5
12 W	8,28	7,35	2,510	12,4	8,65	2,559	12,5
13 WNW	7,65	6,79	2,545	8,6	8,03	2,589	8,5
14 NW	7,84	6,97	2,686	6,9	8,34	2,725	6,9
15 NNW	7,20	6,38	2,389	4,7	7,70	2,424	4,8
All	7,99	7,07	2,150	100,0	8,43	2,185	100,0

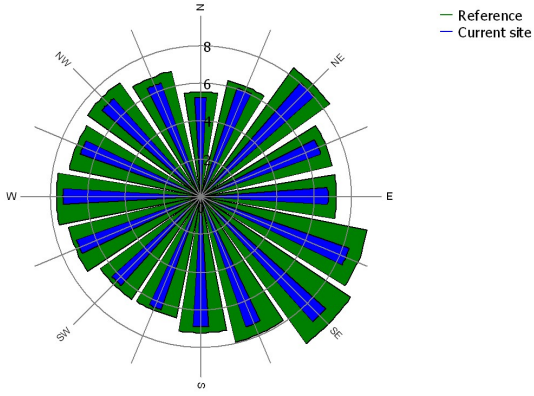
Weibull Distribution



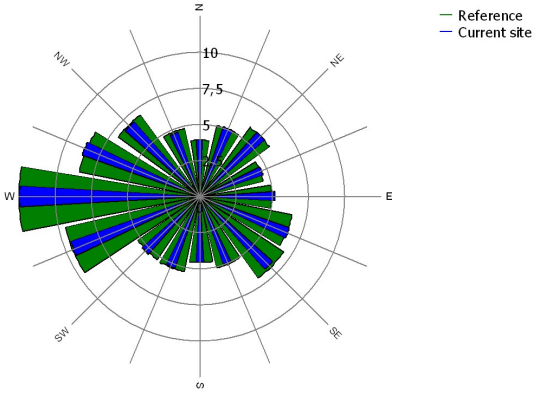
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



Project:
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Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Wind Data Analysis

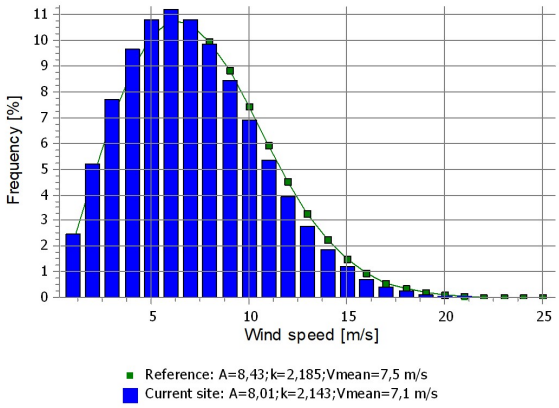
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

Site coordinates
UTM (north)-WGS84 Zone: 29
East: 742.707 North: 4.066.259
AEG-05
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

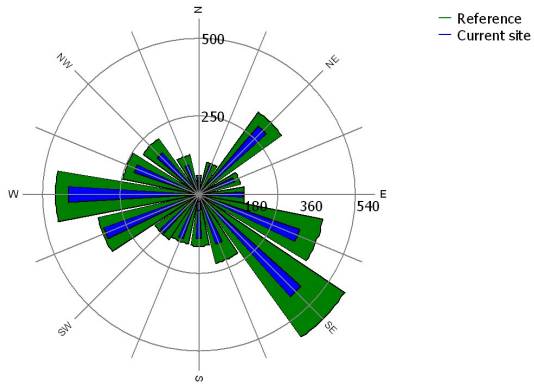
Weibull Data

Sector	Current site A-parameter [m/s]	Current site Wind speed [m/s]	Current site k-parameter	Current site Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	Reference: Roughness class 1 k-parameter	Reference: Roughness class 1 Frequency [%]
0 N	5,96	5,28	2,119	3,9	6,26	2,112	3,9
1 NNE	6,85	6,07	2,318	5,1	7,11	2,437	5,0
2 NE	9,09	8,05	2,146	6,0	9,50	2,170	5,9
3 ENE	7,67	6,81	2,529	4,7	8,09	2,524	4,5
4 E	7,66	6,79	2,432	5,3	8,09	2,690	5,0
5 ESE	9,56	8,47	2,369	6,5	10,18	2,405	6,5
6 SE	10,06	8,91	2,146	6,6	10,81	2,164	6,9
7 SSE	8,17	7,24	2,225	4,9	8,93	2,243	5,1
8 S	7,76	6,88	2,076	4,5	8,16	2,097	4,6
9 SSW	7,19	6,39	1,826	5,2	7,34	1,831	5,3
10 SW	7,17	6,39	1,717	5,4	7,36	1,736	5,2
11 WSW	7,99	7,07	2,107	9,6	8,14	2,155	9,5
12 W	8,34	7,40	2,506	12,5	8,65	2,559	12,5
13 WNW	7,64	6,79	2,549	8,6	8,03	2,589	8,5
14 NW	7,78	6,91	2,678	6,8	8,34	2,725	6,9
15 NNW	7,15	6,34	2,393	4,6	7,70	2,424	4,8
All	8,01	7,10	2,143	100,0	8,43	2,185	100,0

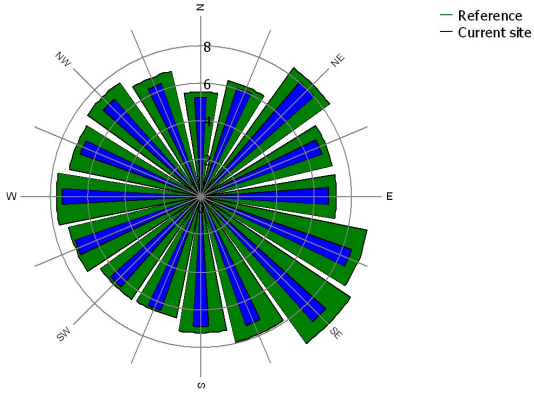
Weibull Distribution



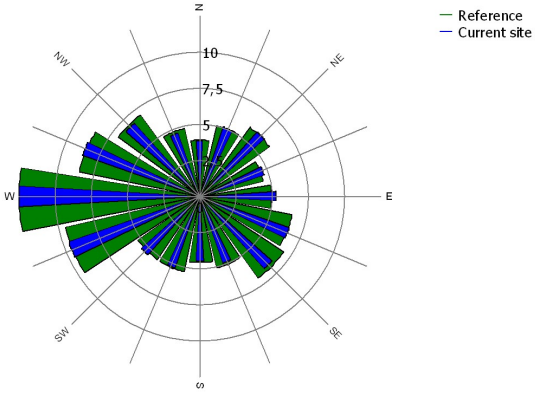
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

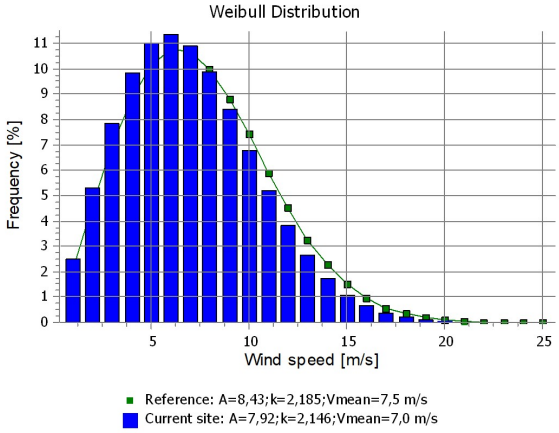
PARK - Wind Data Analysis

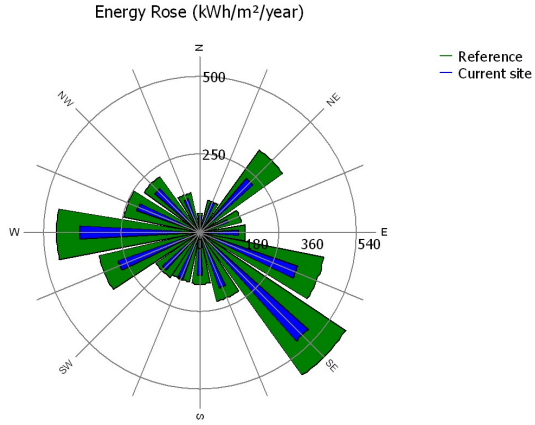
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

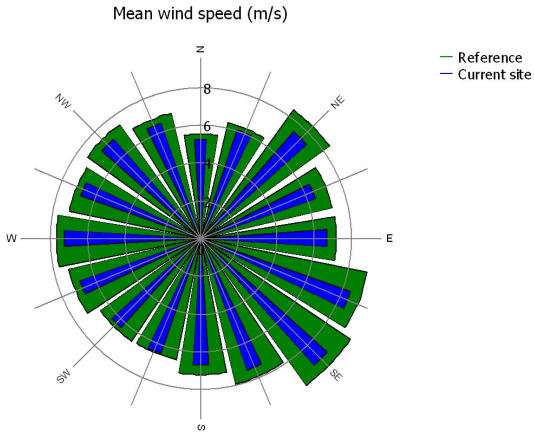
Site coordinates
UTM (north)-WGS84 Zone: 29
East: 745.092 North: 4.063.165
AEG-06
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

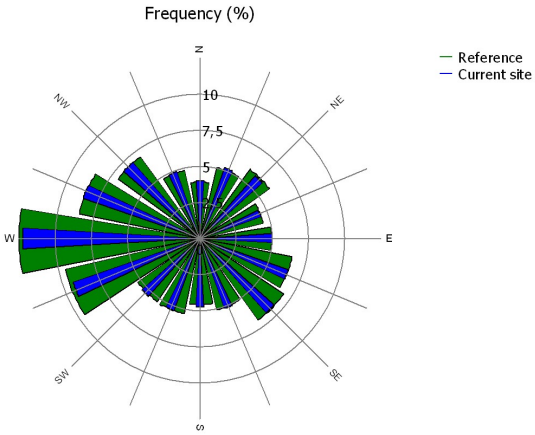
Weibull Data

Sector	Current site A-parameter [m/s]	Current site Wind speed [m/s]	Current site k-parameter	Current site Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	Reference: Roughness class 1 k-parameter	Reference: Roughness class 1 Frequency [%]
0 N	5,94	5,26	2,119	4,0	6,26	2,112	3,9
1 NNE	6,85	6,07	2,291	5,2	7,11	2,437	5,0
2 NE	8,48	7,51	2,154	5,8	9,50	2,170	5,9
3 ENE	7,25	6,44	2,557	4,5	8,09	2,524	4,5
4 E	7,54	6,69	2,506	5,0	8,09	2,690	5,0
5 ESE	9,51	8,43	2,381	6,5	10,18	2,405	6,5
6 SE	10,14	8,98	2,150	6,9	10,81	2,164	6,9
7 SSE	8,33	7,38	2,209	5,1	8,93	2,243	5,1
8 S	7,60	6,73	2,061	4,7	8,16	2,097	4,6
9 SSW	7,26	6,45	1,818	5,3	7,34	1,831	5,3
10 SW	7,12	6,35	1,721	5,3	7,36	1,736	5,2
11 WSW	7,69	6,81	2,111	9,2	8,14	2,155	9,5
12 W	8,19	7,26	2,510	12,2	8,65	2,559	12,5
13 WNW	7,61	6,76	2,557	8,5	8,03	2,589	8,5
14 NW	7,90	7,02	2,689	7,0	8,34	2,725	6,9
15 NNW	7,30	6,47	2,396	4,9	7,70	2,424	4,8
All	7,92	7,01	2,146	100,0	8,43	2,185	100,0









Project:
14070_PE Los Morales

Licensed user:
Astrom Technical Advisors, S.L.
C/ Serrano, 8 - 3º izda
ES-28001 Madrid
+34 911460110
Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

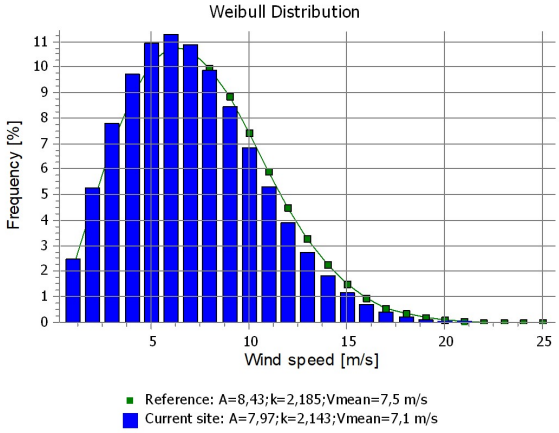
PARK - Wind Data Analysis

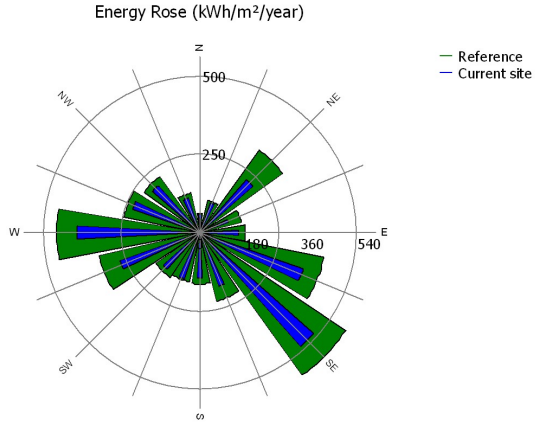
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

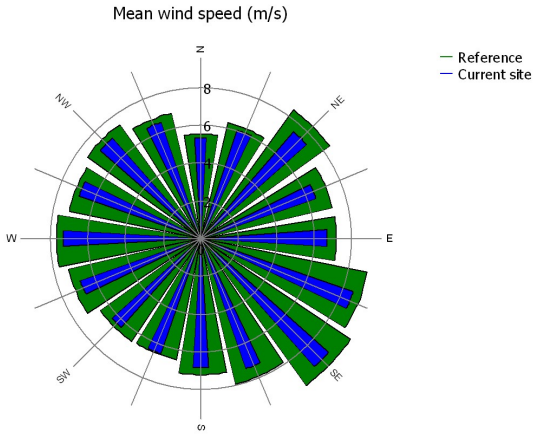
Site coordinates
UTM (north)-WGS84 Zone: 29
East: 744.824 North: 4.062.568
AEG-07
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

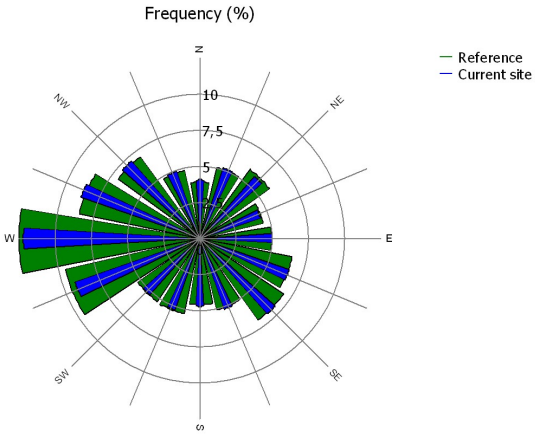
Weibull Data

Sector	Current site A-parameter [m/s]	Current site Wind speed [m/s]	Current site k-parameter	Current site Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	Reference: Roughness class 1 k-parameter	Reference: Roughness class 1 Frequency [%]
0 N	6,01	5,32	2,123	4,1	6,26	2,112	3,9
1 NNE	6,85	6,07	2,287	5,1	7,11	2,437	5,0
2 NE	8,48	7,51	2,150	5,7	9,50	2,170	5,9
3 ENE	7,29	6,47	2,557	4,4	8,09	2,524	4,5
4 E	7,58	6,73	2,510	5,0	8,09	2,690	5,0
5 ESE	9,67	8,57	2,377	6,5	10,18	2,405	6,5
6 SE	10,25	9,08	2,150	7,0	10,81	2,164	6,9
7 SSE	8,24	7,30	2,213	5,2	8,93	2,243	5,1
8 S	7,69	6,82	2,053	4,7	8,16	2,097	4,6
9 SSW	7,28	6,47	1,814	5,2	7,34	1,831	5,3
10 SW	7,11	6,34	1,713	5,2	7,36	1,736	5,2
11 WSW	7,66	6,79	2,107	9,1	8,14	2,155	9,5
12 W	8,25	7,32	2,502	12,2	8,65	2,559	12,5
13 WNW	7,72	6,86	2,553	8,7	8,03	2,589	8,5
14 NW	7,99	7,11	2,686	7,1	8,34	2,725	6,9
15 NNW	7,36	6,52	2,389	4,9	7,70	2,424	4,8
All	7,97	7,06	2,143	100,0	8,43	2,185	100,0









Project:
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C/ Serrano, 8 - 3º izda
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Iván Fernández / ivan.fernandez@ata.email
Calculated:
09/10/2023 17:38/3.6.366

PARK - Wind Data Analysis

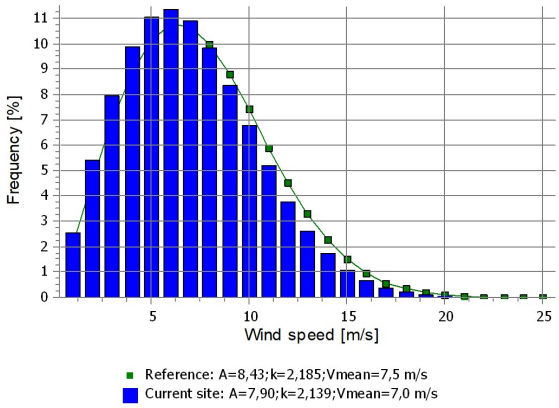
Calculation: WASP-PE Los Morales-7-AEG-NORDEX N175-6.8MW-125m Wind data: A - Datos de empl.: WAsP (8); Hub height: 125,0

Site coordinates
UTM (north)-WGS84 Zone: 29
East: 744.084 North: 4.065.644
AEG-03
Wind statistics
ES VORTEX-Data-AEG-03 - 125.00 m.wws

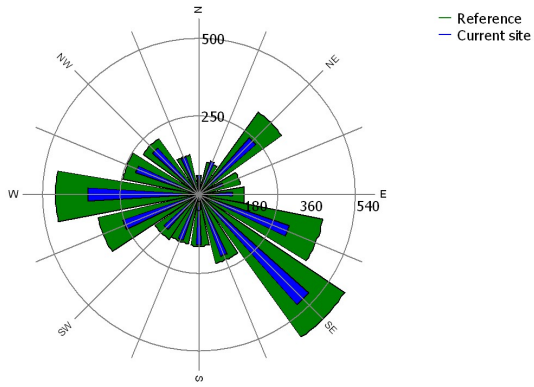
Weibull Data

Sector	Current site A-parameter [m/s]	Wind speed [m/s]	k-parameter	Frequency [%]	Reference: Roughness class 1 A-parameter [m/s]	k-parameter	Frequency [%]
0 N	6,16	5,45	2,123	4,2	6,26	2,112	3,9
1 NNE	7,03	6,22	2,264	5,2	7,11	2,437	5,0
2 NE	8,70	7,71	2,150	5,7	9,50	2,170	5,9
3 ENE	6,94	6,16	2,564	4,3	8,09	2,524	4,5
4 E	7,15	6,34	2,447	4,9	8,09	2,690	5,0
5 ESE	9,29	8,23	2,365	6,4	10,18	2,405	6,5
6 SE	10,16	9,00	2,150	6,9	10,81	2,164	6,9
7 SSE	8,53	7,56	2,201	5,3	8,93	2,243	5,1
8 S	7,92	7,01	2,057	4,8	8,16	2,097	4,6
9 SSW	7,21	6,41	1,814	5,3	7,34	1,831	5,3
10 SW	6,98	6,22	1,736	5,3	7,36	1,736	5,2
11 WSW	7,59	6,72	2,107	8,9	8,14	2,155	9,5
12 W	8,04	7,13	2,514	11,9	8,65	2,559	12,5
13 WNW	7,58	6,73	2,545	8,6	8,03	2,589	8,5
14 NW	7,94	7,06	2,678	7,2	8,34	2,725	6,9
15 NNW	7,50	6,65	2,412	5,1	7,70	2,424	4,8
All	7,90	6,99	2,139	100,0	8,43	2,185	100,0

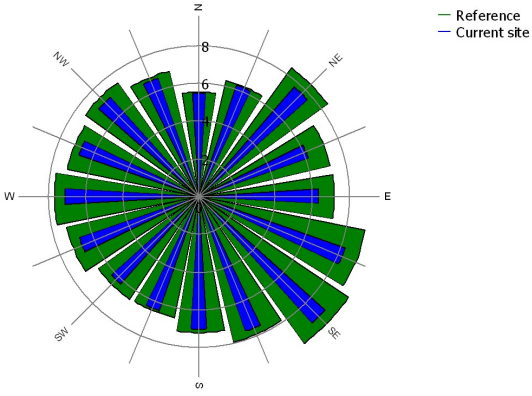
Weibull Distribution



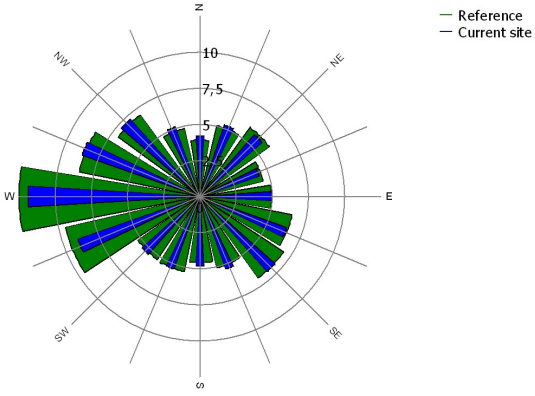
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



Anexo II: Planos

INGNOVA PROYECTOS
Consultoría Agronómica e Industrial
mcm@ingnova.es
www.ingnova.es

C/ Tomás de Aquino, 14 (Local)
14.004 – Córdoba - España
Tlf: +34 957 08 92 33
Móvil: 655 35 98 99

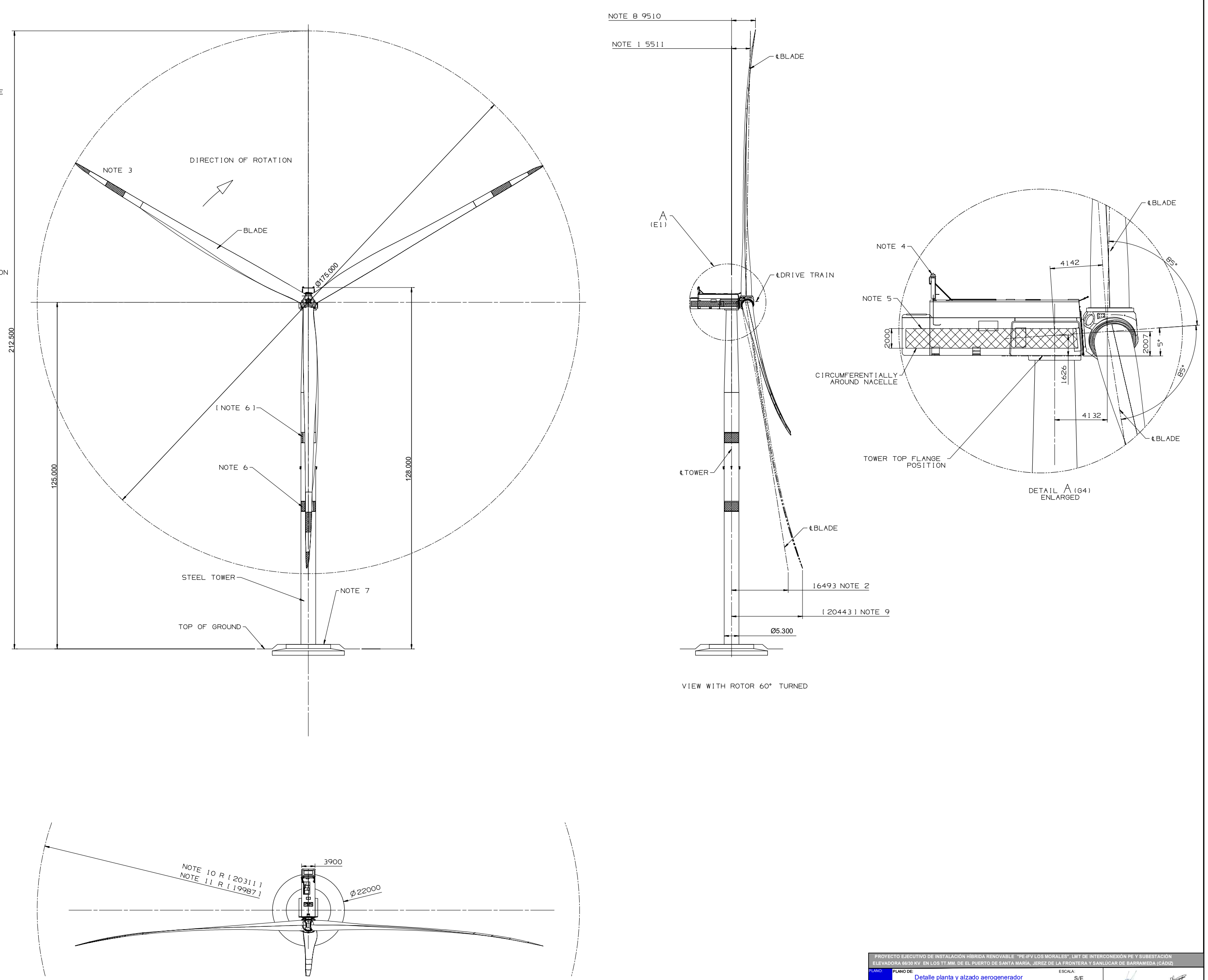
AEROGENERADOR NORDEX-ACCIONA N175/6.X

NOTES:

DIMENSIONS AND DESCRIPTION IN ( ) ARE OPTIONAL.
DIMENSIONS AND DESCRIPTION IN [ ] ARE ALTERNATIVE MARKING, WHICH CAN BE USED INSTEAD.

THIS DRAWING SHOWS A STANDARD CONFIGURATION ONLY. COUNTRY AND SITE SPECIFIC REGULATION MAY VARY.

1. ECCENTRICITY EB: DISTANCE BETWEEN TOWER CENTER AND BLADE TIP IN OPERATION.
2. DISTANCE AB: DISTANCE BETWEEN TOWER CENTER AND BLADE TIP IN OPERATION.
3. DAYLIGHT IDENTIFICATION 3X6m ON EACH BLADE RED-LIGHTGREY-RED : RAL 3020, 7035, 3020 [ORANGE-WHITE-ORANGE: RAL 2009, 9016, 2009]
4. NIGHT IDENTIFICATION: TWO AVIATION LIGHTS W-RED
5. DAYLIGHT IDENTIFICATION BOTH SIDES OF NACELLE: 2m RED : RAL 3020 [2m ORANGE: RAL 2009]
6. DAYLIGHT IDENTIFICATION AT TOWER: 3m RED : RAL 3020 [3m ORANGE: RAL 2009]
7. FOUNDATION SHOWN IS FOR INFORMATION ONLY.
8. ECCENTRICITY ES: DISTANCE BETWEEN TOWER CENTER AND BLADE TIP IN IDLE.
9. DISTANCE AS: DISTANCE BETWEEN TOWER CENTER AND BLADE TIP IN IDLE.
10. DISTANCE FROM TOWER CENTER TO BLADE TIP IN IDLE AREA: 20311m²
11. DISTANCE FROM TOWER CENTER TO BLADE TIP IN OPERATION AREA: 19987m²



PROYECTO EJECUTIVO DE INSTALACIÓN HÍBRIDA RENOVABLE "PE-IFV LOS MORALES", LMT DE INTERCONEXIÓN PE Y SUBESTACIÓN ELEVADORA 66/30 KV EN LOS TT.MM. DE EL PUERTO DE SANTA MARÍA, JEREZ DE LA FRONTERA Y SANLÚCAR DE BARRAMEDA (CÁDIZ)

PLANO:	PLANO DE:	ESCALA:		
1.4	Detalle planta y alzado aerogenerador	S/E	INGENIERO TÉCNICO SUPERIOR (coleg.:1.617) MANUEL CAÑAS MAYORDOMO	INGENIERO INDUSTRIAL (coleg.:7.426) DANIEL CORRERO CABRERA
Hoja 1 de 1	ingnova PROYECTOS · bogaris	PROMOTOR: Iberian Retail Bemesga 6, S.L.U.	Julio 2023	